Frost (Ed.)

A PRELIMINARY DISCUSSION

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MILLER'S RIVER NUISANCE,

AND ITS REMEDY.

By Edward Frost, Civil Engineer.

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REPORT.

THE following Report is prepared and subscribed by the civil engineer employed during the last four years of Somerville's corporate existence, preceding its organization as a city, to devise and apply its general system of sewers and drains. The new methods and policy of Somerville appear to him calculated or likely to inflict needless and unwarranted interference with business facilities, and likely or certain to result, if their execution is attempted, in prolonging and aggravating, with no early or visible limit, the sufferings of the community.

To begin with a word of protest. This question is to constitute a study in physical science. Testimony from a hundred or five hundred people of good intelligence and general information, to the effect that they see, or that they put faith in, no means for the re-formation of the river-basins, and for the cure and remedy for their present polluted condition consistently with their preservation, contributes nothing of the nature of proof, scarcely even of presumption, that such reformation, such cure and remedy, is not practicable in some way, or even several ways. Some other means there may be, whose operation shall be found, on due inquiry, to be cheaper, quicker, surer, every way more feasible.

I will suggest the following enumerations, under one or another of whose alternative heads we may group any and perhaps all plans, even those including the widest diversity as

to their "dimensions and limits and modes of performing whatever may be authorized" or contemplated; to wit, —

1. Plans which propose to cover with solid filling the foul muds forming the floors of all basins above the Lowell Railroad, and which exclude the question of drainage as impertinent, or not appropriate to the cognizance of the commission created last winter.

2. Plans which recognize the relation of drainage, as a physical law (operating differently in the several basins), to the main matter of inquiry.

Again we may have, —

1. Plans which aim at covering, more or less promptly, all the dirty mud in the basins, ignoring, meanwhile, collateral sanatory problems.

2. Plans securing a provision against the continuous reception of house and other sewage from above, and the dirty wash of ascending tides from below.

And again we may have, —

1. Plans which disregard the sources of power residing in tidal heads, available for the propagation of currents.

2. Plans which recognize and attempt to utilize in methodical processes the grand scavenging agency of the tides.

And, finally, we may have, —

1. Plans undertaken or advocated as the sum and substance of a few general impressions, loosely conceived.

2. Plans which illustrate the fruits of a conscientious special study.

In the first-named of my contrasting alternatives, the matter of *drainage*, or outflow of rainfall, springs, tidal volumes, &c., apart and distinct from sewage and other causes of defilement, is put forward as claiming recognition.

The lower or Squire's Basin differs from the basins above in this cardinal particular: it is self-draining; there being no dam or obstruction (now) to prevent its running empty. The basins above are not self-draining, and cannot be emptied,

as they exist to-day, without resort to pumping, or to the construction of some new channel of outlet. They never have been emptied since the construction of the sluice and guard gates at the Fitchburg Railroad, near North and Merriam's. The sill of these gates (and therefore the bottom of the waterway) is reported to be 4.28 feet above mean low tides of Boston Harbor. The bottom of the stagnant pool thus created above it, and extending a distance of some three thousand feet along the thread of the channel, contains drifted heaps of sedimentary matters, and hollows of stagnant water between the heaps. It is high enough to make acres of shoal water; not high enough to empty itself across this remarkable obstruction. While the descent of the tide through its lower stages, and its return to a point very little below the half-tide plane, is occurring, this pestilent pool, this shallow and dirty puddle, is distilling its nuisance under summer heats, from fourteen or fifteen acres of surface, and from its reaches of flat and winding beach, bordered by putrid carcasses and filth, of a mile or more in linear extension.

The city of Cambridge, last summer, thought fit to place, and did place, in the outlet to the Squire Basin, a like obstruction; only a higher one,—as much higher as they had time and perseverance to devote to the execution of a mode promising relief in their view, and still (and happily) not absolutely tight, nor high enough wholly to prevent change of water in the Squire Basin. Deep and comparatively cool, and enjoying to some extent the changes of volume forced in through the imperfect workmanship of this abortive construction, the extent of injury to the public health from the water thus retained in the Squire Basin, during the brief maintenance of the full basin, was perhaps not more than would have been the emanations from its muds during the semi-diurnal exposures of low tide. But in the shallow reaches above Medford Street, wholly beyond the qualifying influences enjoyed below, and with westerly winds blowing, extreme stagnation ensued; and a volume of effluvia was exhaled, which swept the highways and railroads below as with the breath of a destroying angel,—a simoom of pestilence.

It came "from the direction" of the slaughter-houses. Did the slaughter-houses cause it? Inconsiderate judgments, and minds uneducated to discriminating inquiry, and people capable of committing and tolerating the blunder of administration which is herein described, will hasten to pronounce in the affirmative; but the inquiries necessary to localize properly and unmistakably the malarious influences have not, thus far, been made.

But positive evidence is by no means wanting. The smells *from below high-water line* originate mainly in the *shallow basins*. I quote the testimony of Mr. Heywood, superintendent of the Fitchburg Railroad, as given at the hearings last winter before the legislative committee with whom originated the act under which the present commission sits. In that testimony he declared that the chief complaint amongst his passengers was of the nuisance experienced on the "inward stop," with the trains standing across Medford Street, and abreast of the undrained upper basins.

This is further corroborated by the recent private and unsolicited statement of the president of the same road, "that the Squire Basin isn't the one that smells: it is the upper basins that smell the worst. I don't know why it is, and I can't imagine what it is that makes them smell so; but that is the fact." This statement I personally received from him at a recent interview.

The mud in hot weather gives off the most offensive odors; and their source is in the offal and refuse floated up from below, and delivered into the basins from above and from their borders during years past, while they have served as settling basins, accumulating vile deposits, with no chance of running themselves clean.

It is not the nuisance existing in and upon the Squire Basin that this board is to provide how to abate. It is the nuisance existing in and upon the territory bounded as follows: North-easterly by the Boston and Lowell Railroad in Cambridge and Somerville, north-westerly by the Fitchburg Rail-

road in Somerville, northerly by Milk Street in Somerville, westerly by Prospect Street in Somerville, south-westerly by Webster Avenue in Somerville, southerly by the boundary line between Cambridge and Somerville and by Gore Street in Cambridge, easterly by Fifth Street in Cambridge, southerly by Winter Street in Cambridge, and easterly, in Cambridge, by Fourth Street and the line of Fourth Street extended to the Boston and Lowell Railroad. And this, is what is meant by the words "lower basin" in the caption of the act.

Except as to the Merriam Basin and the Squire Basin, no diversity of opinion exists as to the means of abating the nuisance. Above Medford Street, the wants of the adjacent districts, both north and south of the water-spaces, call for a solid filling and an artificial drainage; the latter, when perfected, to supersede the natural water-course, but, until perfected, relying upon it as an auxiliary.

Artificial drainage is here necessary; because the natural drainage has been obstructed, and we do not anticipate the demolition of the obstructions. Here, indeed, is a nuisance that has to be "buried."

The fouling of these basins cannot be cleansed by washing, since there is no exit for the wash. The form in which they lie is unfavorable to including them with the others in a scheme for the preservation of the entire water-space. It is the best we can do with it; and no controversy exists over it, that we should divert the sewage, and afford a drainage, by channels conducting to a lower point of discharge.

But the Squire Basin, to the eye of an engineer, presents features and capacities worthy of study. It may be used for storage of tidal volumes to generate seaward currents; and, of these currents, the Cambridge sewer, about to be built on the line of Broad Canal, may hereafter illustrate the necessity, and enjoy the relief.

It can be flooded during summer heats at small expense by a method below described; and the flooding can be changed by drawing off and refilling on a single tide, whenever an

easterly wind reduces the temperature and affords the opportunity of exposing the flats with little offence.

And other means for its preservation and improvement will appear in the further course of this inquiry.

But it will be seen at a glance to possess one characteristic distinguishing it absolutely from the upper basins; viz., it is *self-draining*, and we need not (as indeed we cannot) better its drainage by giving it a sewer or drain. It drains itself completely, and runs entirely empty as far down as the tide falls. Remove, if you choose to abandon its use as a reservoir, a portion only of the artificial encroachments upon the width of its outlet (structures maintained by Tebbitts and Merrill), and you may perhaps sufficiently restore its original estuary form and self-purifying habits.

Before, however, resorting to such a measure, we should probably prefer to introduce gates at this contracted outlet (separate in their operation from the flooding arrangement, though combined in the same structure) by which to command the service of the tides in purifying both the basin and the estuary below, down to Charles-river channel, as follows: —

On a rising tide, the upper and purer strata may be separated from the lower and fouler portion of the tidal volume by half-tide barrier-gates, self-closing as the tide rises, and thus obstructing the ingress of the impurities. The gates, being built to swing open with the ebb, when the tide changes will deliver a seaward current of pure water against these arrested impurities: it will give them a seaward movement.

This automatic process, if moderate in action, is yet efficient in principle. Experiment would teach us whether there is need of auxiliary current power to carry the lagging ebb of the estuary farther seaward than its own strength (in its later stages) could take it. If needed, it would be afforded at once by simply adjusting the gates during the outflow, so as to time the discharges favorably. Amelioration and improvement would necessarily ensue both in basin and estuary.

The Merriam Basin, or reservoir, when raised, as hereinafter

proposed, to grade five (5), or half-tide level, throughout its whole area, becomes self-draining, and as a compartment or division, conveniently isolated from adjoining territory by the existing streets, and connecting with the Squire Basin by a sluice with gates already constructed, is worthy of preservation and use, till experience shall more completely demonstrate its serviceability as an adjunct of the main basin.

The sewage and refuse of the shores above Medford Street, abounding in filthy features and practices, as described in official reports of Cambridge and Somerville, is still received, with accessions from all quarters, into the upper basins. Corporate authorities, not less than individuals, still seem to find a "temptation, too strong to be resisted, to cast into the pool the refuse fluids and solids which must be got rid of."

Witness the route laid out and followed in the construction of a Somerville sewer, built within a month in Washington Street, near the Square, and across Milk Street, in a general westerly direction, to strike the head of these basins in Prospect Street. The inducement thus to conduct drainage and sewage in a route opposed to the general system (which, of course, slopes down to the eastward) was the fact that this route was the shortest way to the open basin; and there the sewage has still to go and find its lodgment.

We must postpone (not, however, forgetting or ignoring) plans and means for the utilization of the great bulk of our sewage, till the more perfect light of a successful experience shall show how thus to avoid its dispersion and loss. The offal and excrementitious matter which necessarily attends the presence of a population, and the prosecution of ordinary business-pursuits, is rightfully delivered to the sewers, where sewers exist. The "washings," which cannot be carted away, must, of course, be admitted to run away; but the blood as it runs from the knife, and all other undiluted offal of the slaughtering establishments, should be with scrupulous

care, and by inexorable regulation, wholly excluded from the channels and currents to which, for the present, we commit other sewage matters.

Two tons per head per annum is the ordinary estimate representing the contributions of defiling matter from an ordinary population. This is the exigency to be met, — that we shall convey and disperse by water-currents, in artificial drains leading to outlets whose dispersing forces are a fact or a possibility, this large and growing bulk of sewage.

As we have already remarked, *drainage*, both of water accumulations and of sewage, is a measure of practical value and immediate relief to the spaces above Medford Street. We should make haste to employ the means and secure the benefit of this drainage by resort to the *earliest obtainable outlet affording a means of dispersion.*

This may be *via* Broad Canal, through Cambridge, or through Milk Street in Somerville, providing we have reservoirs, — not without them. Or the route may be *via* Medford and Gore Streets to the foot of Fourth Street, in East Cambridge; thence ultimately to extend along the Cambridge shore, behind the wharves yet to be built, to Lechmere Point, the true point for complete dispersion. Or Lechmere Point may be reached, with moderately deep cutting, by way of Gore and Bridge Streets.

By this means excluding ordinary sewage, and, by regulations applying to the slaughter-houses, providing against *all further* accessions of defiling matter, we insure that the purifying visits of the tide, operating as before described, will gradually relieve and finally wholly restore the basin; in which work the Merriam Reservoir may efficiently co-operate. While awaiting these proceedings and their expected results, we command instant and complete relief by recourse to flooding, as exigency of times and seasons may, from time to time, require.

TEMPORARY AND PERMANENT PLANS.

The proposed means of separating the purer portion of incoming tides from the impure consists of half-tide barrier-gates, — self-acting, to close as the tide rises, and to open as it changes to ebb.

The proposed means of flooding consists of a simple and familiarly known combination of grooves and stop-plank, forming a water-tight dam or barrier, yet removable at will. It will be carried to the height at which it is proposed to keep the basin flooded. I recommend not less than ten feet above mean low water: this is the average or ordinary high-water line.

As to *Temporary Measures*, the last two Annual Reports of the town officers of Somerville point to causes poisoning the air from sources situated above High Water line. These causes can be discovered by vigilant surveillance, and should be crushed out with unrelenting rigor. Below High Water the power to flood and to keep flooded during low-water stages, with occasional withdrawal and replenishment at favorable junctures, provides for temporarily neutralizing the causes of stench, so far as they exist in the deeper basin.

From October to May, since temperature must combine with foulness to breed the offensive or malarial gases, this process may not be needed; but until next October, and again next summer, if needed, I would employ a course of flooding, with changes of water at hours and temperatures favorable for the exposure of the flats.

The *Permanent Measures* which occur to me as best for abating the nuisance or nuisances existing below high-water mark in the basin of Miller's River, and extending from Prospect Street to Lowell Railroad Bridge, and involving also the estuary below, down to its mouth, are as follows: —

1. Extend all existing sewers and drains, whether by trunk, or parallel lines, to points of discharge below the basin, — ultimately not higher up than Lechmere Point.

2. Intercept all defiling matter, fæcal, animal, or vegetable, on its way to the basin, by these lines thus extended, and by new ones, ramifying and connected therewith.

3. Cover with solid filling to grade thirteen (13), the first and second of the smaller basins, — viz., all above Medford Street, — preserving the thread of the channel or an equivalent conduit for salt water.

4. In the basin bounded by the Fitchburg Railroad and Milk and Medford Streets, re-form the outline, and raise the bottom to grade five (5). Bulkhead the margin all round, and preserve this, with existing gates, as a reservoir.

5. Widen the outlet waterway at Bridge Street, so as to be not less than the waterway between the abutments of the Lowell Railroad Bridge; and between said abutments remove old piles and other obstructions.

6. Between Milk Street and the Lowell Railroad, bulkhead the parallel sides of the proposed waterway, and raise the lands to grade thirteen (13).

7. *As a substitute* for 5 and 6, maintain and operate the barrier-gates and stop-plank by which to utilize the Squire Basin as a tidal reservoir, valuable and sufficient not only for Cambridge and Somerville low lines of sewer adjacent, and for sweeping their outlets, but for cleansing the great commercial basin below the Lowell Railroad Bridge in all future time.

By execution of the foregoing plan of permanent and temporary measures, I hold that it is practicable speedily to mitigate, and finally, and with reasonable dispatch, wholly to remove and suppress, the existing nuisance on Miller's River, in Cambridge and Somerville.

EDWARD FROST,
Civil Engineer.

Boston, July 5, 1872.